

**Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs
DEPARTMENT OF ENERGY RESOURCES**

**GUIDELINES ON THE ELIGIBILITY AND METERING OF COMBINED HEAT AND
POWER PROJECTS FOR THE ALTERNATIVE ENERGY PORTFOLIO STANDARD
("CHP GUIDELINES [FOR APS]" or "GUIDELINES")**

Contents:

1. Explanation and Assumptions for Certificate Calculation
2. Approved CHP System Meters
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1. Explanation and Assumptions for Certificate Calculation

A MA APS-qualified CHP Unit should receive NEPOOL GIS certificates with Alternative Energy Attributes (termed Alternative Energy Certificates, abbreviated AECs) to the extent that the Unit is optimally-designed in relation to its electrical and thermal loads, uses excellent technology, and is well operated maintained and operated. The formulas by which the quantity of Attributes of the CHP Unit is determined calculate the amount by which the energy input to the CHP Unit to produce a given electrical and thermal output is less than the energy input that would be required if those same outputs came separately from the electrical grid and an on-site boiler.

The formulas assume (a) an overall efficiency of 33% for electrical energy delivered to the end-use from a central plant via the grid (both generation and transmission losses considered), and (b) an overall efficiency of 80% for thermal energy delivered to a stand-alone heating unit on site.

Because the NEPOOL GIS can mint certificates only terms of MWh of electricity, all values in the formula are converted to MWh, with 3,412 thousand Btu of Useful Thermal Energy and of input fuel being equivalent to one MWh of electrical energy.

Use Worksheet 3 in the CHP Supplement to calculate projected AECs, and enter the results in SQA Section III.2.B.d.

Calculation for a New CHP Unit (expressed in prose)

(Electrical energy generated per calendar quarter in MWh) / 0.33

plus ([Useful Thermal Energy produced per calendar quarter in MMBtu] / 3.412 MMBtu/MWh) / 0.8

minus (all fuel and any other incremental energy consumed per calendar quarter in MMBtu / 3.412 MMBtu/MWh)

equals Alternative Energy Attributes (as AECs) per calendar quarter in MWh

Calculation for Incremental CHP at a Pre-2008 Unit (expressed in prose)

(Incremental Electrical Energy¹ generated per calendar quarter in MWh) / 0.33

plus ([Incremental Useful Thermal Energy² produced per calendar quarter in MMBtu] / 3.412 MMBtu/MWh) / 0.8

minus (all Incremental Fuel³ & any other incremental energy consumed per calendar quarter in MMBtu / 3.412 MMBtu/MWh)

equals Alternative Energy Attributes (as AECs) per calendar quarter in MWh

¹ "Incremental Electrical Energy" is defined in 225 CMR 16.02 as the electrical energy generated by a CHP Unit that is either greater than (expressed as a positive amount) or less than (expressed as a negative amount) the electrical energy generated by the CHP Unit prior to the addition of new electric generation nameplate capacity, Useful Thermal Energy, or Incremental Useful Thermal Energy.

² "Incremental Useful Thermal Energy" is defined in 225 CMR 16.02 as the Useful Thermal Energy produced by a CHP Unit that is distinct in its final distribution, beneficial measure, and metering from Useful Thermal Energy previously produced by the CHP Unit, but only to the extent that the Incremental Useful Thermal Energy does not reduce the Useful Thermal Energy previously produced.

³ "Incremental Fuel" is defined in 225 CMR 16.02 as the amount of additional fuel used by a CHP Generation Unit which is attributable to the production of Incremental Useful Thermal Energy or Incremental Electrical Energy.

2. Approved CHP System Meters for ACP**General Notes:**

- 1) All meters required by the APS must meet and conform to all applicable Laws, Ordinances, Codes, Regulations and Standards
- 2) All meters required by the APS must be of Revenue Grade quality and reliability.
- 3) It is preferred, but not required that APS meters have the capability to generate and transmit a signal for remote reading.

FUEL METERS

Natural Gas				
Meter Type	Flowrate Range	Accuracy	Minimum Frequency of Calibration	Other
Diaphragm (Temperature Compensated)	$2\% \leq \text{Flow} \leq 100\% \text{MaxDF}$	$\pm 2\%$	Annual	MaxDF is <u>Maximum</u> Design Flow Rate
All Others	$20\% \leq \text{Flow} \leq 100\% \text{MaxDF}$	$\pm 1\%$	Annual	MaxDF is Maximum Design Flow Rate
	$\text{MinDF} \leq \text{Flow} \leq 20\%$ Where MinDF	$\pm 2\%$	Annual	MinDF is the Minimum Design Flow Rate

Natural Gas Meter Notes:

- 1) All volumetric measurements must be adjusted to Standard Cubic Feet (i.e. corrected for temperature and pressure)
- 2) For each month in which the CHP system is in operation, the average monthly Lower Heating Value (LHV) must be obtained from the natural gas supplier and made available to the independent meter reader.
- 3) A gas meter furnished and installed as a part of a dedicated gas line to the CHP system by the applicable gas utility, will be accepted as an approved natural gas fuel meter.

Liquid Fuels				
Meter Type	Flow rate (% Design Maximum Flow)	Accuracy	Minimum Frequency of Calibration	Other
Positive Displacement	Full Range	$\pm 1\%$	Annual	See general and specific Notes.

Liquid Fuel Meter Notes:

- 1) The approved meter standard above applies to the following ASTM fuels (with associated lower heating values): B-100 (120,714 BTU/gallon); M-100 (56,800 BTU/gallon); E-100 (76,100 BTU/gallon).
- 2) M-100 and E-100 are each eligible only if derived from biogenic, non-petrochemical based sources.
- 3) Blended and non ASTM Fuels: The approved meter standard above does not apply for these cases. **NOTE: The standard for blended and non-ASTM fuels is RESERVED and will be issued in a future edition of the SQA.**

BioGas (Landfill Gas, Digester Gas)				
Meter Type	Flow rate (% Design Maximum Flow)	Accuracy	Minimum Frequency of Calibration	Notes:
RESERVED				

NOTE: The standard for BioGas Meters is RESERVED and will be issued in a future edition of the SQA.

THERMAL ENERGY METERS:

Thermal Energy - Steam Service					
Line Size	Meter System		BTU Meter Field Accuracy	Minimum Frequency of Calibration	Notes:
	Flow Element	Temperature Element			
$\geq 8"$	Orifice Plate with Differential Pressure Element and Transmitter	Only with superheat.	$\pm 3\%$	Annual	If significant fraction of flow occurs at velocities well below design, may undercount flow and BTU's. Can be addressed by installing a two meter manifold with a normal to high meter in parallel with a low flow meter.
$< 8"$	Vortex Shedding Tube	Only with superheat.	$\pm 3\%$	Biannual	

Thermal Energy - Hot Water					
CHP Output	Meter System		BTU Meter Field Accuracy	Minimum Frequency of Calibration	Note:
	Flow Meter and BTU Computer	Temperature Measurement			
> 10kW	In-line Ultrasonic Flow Tube (no strap-on) or Magmeter; BTU Computer and Totalizer.	Yes	±3%	Biannual	Temperature elements installed in thermowells.
≤ 10kW	In-line Ultrasonic Flow or strap-on or Magmeter; BTU Computer and Totalizer	Yes	±3%	Biannual	Temperature elements installed in thermowells or securely mounted with excellent thermal contact and insulation on piping.

3. **List of Other Documents that Must Be Submitted with the Application**

- a. Completed **CHP System Information Data Sheets** (*provided in the CHP Supplement*)
 - DS#1: Genset(s) (prime mover and generator)
 - DS#2: CHP Heat Recovery System(s)
 - DS#3: APS Meters for CHP Systems
 - DS#4: Generator and Electrical Distribution System(s)
- b. Completed **CHP Worksheets** (*provided in the CHP Supplement*)
 - Table 1, Thermal Loads Used as Basis of Design
 - Table 2, Total Electrical Usage for All Electrical Loads to Be Served by the CHP System
 - Table 3, Projected Baseline CHP Average Annual System Performance
 - Table 4, Projected Net Carbon Dioxide Emissions Rate from CHP System
- c. **System APS Meters** - Manufacturer's Specifications and Technical Data Sheets
- d. **General Site Plan** Showing Existing and Proposed Structures & Utilities & Property Lines (only if the mechanical tie-in with the existing system occurs at more than one building)
- e. **Equipment Arrangement Plan** (Mechanical & Electrical) Including Points of Connection with Existing Equipment and/or Distribution Systems
- f. **System Process Flow Diagram** for Each Major Operating Mode , Including:
 - Location of all APS required meters
 - Major Equipment and Piping and Instruments
 - All Thermal Dumping Sub-Systems
 - Applicable Process Values (e.g. kW, Temperature, Pressure, Enthalpy (BTU/lb), mass flow rate (lb/min or lb/hr) at Inlets and Outlets of all major equipment and at each main Points of Connection with Existing Systems.
- g. **One-line Electrical Distribution and Interconnection Diagram**

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- h. **System Controls:** Description, Including a Narrative of the sequence of controls for each of the system principal operating modes.
 - **Measurement of Useful Thermal Energy Delivered for Gas Turbine with Heat Recovery Steam Generator (HRSG) CHP Systems with Supplemental Duct Firing**